



## Identifying Elements by Their Emission Spectra

### TARGET SKILLS

- Predicting
- Performing and recording
- Analyzing and interpreting
- Communicating results

The emission spectra of atomic hydrogen gas obtained using gas discharge tubes provided Bohr with critical information that helped him to develop his model of the atom. These spectra also gave him experimental data with which to compare predictions based on his model. In this investigation, you will identify gases from observation of their emission spectra.

### Problem

Identify gases from observation of their emission spectra.

### Equipment



- hand-held spectroscope
- lighted incandescent bulb
- gas discharge tubes

### Procedure

1. Practise using the spectroscope by observing a small incandescent light bulb. Point the slit of the spectroscope toward the bulb and move the spectroscope until you can clearly see the spectrum.
2. Record the appearance of the spectrum from the incandescent bulb.
3. Several numbered gas discharge tubes will be assembled and ready to view. Observe each tube with the spectroscope.

**CAUTION** A very high voltage is required to operate the gas discharge tubes. Do not come into contact with the source while viewing the tubes.

4. Make a sketch of each spectrum. Draw the relative distances between the lines as accurately as possible. Label each of the lines in each sketch with colour and wavelength to two significant figures.
5. Observe a fluorescent bulb with the spectroscope.

6. Record the appearance of the spectrum from the fluorescent bulb.

### Analyze and Conclude

1. In a phrase, describe the spectrum of the incandescent bulb. Explain why the incandescent bulb emits the type of spectrum that you described.
2. Your teacher will provide you with spectra of a variety of types of gases. Compare your sketches with the spectra and attempt to identify each gas in the discharge tubes.
3. Compare your observations of the fluorescent bulb with the spectra from both the incandescent bulb and the gas discharge tubes. Which type of spectrum does the spectrum from the fluorescent bulb most resemble?
4. A fluorescent bulb is a type of gas discharge tube. However, the emissions of the gas are absorbed by a coating on the inside of the bulb and the atoms in the coating are excited and emit light. Based on this description, explain the features of the spectrum of the fluorescent bulb.
5. Is it possible to identify the gas in the fluorescent bulb? Explain why or why not.

### Apply and Extend

6. Select one of the central lines in the spectrum of atomic hydrogen. Predict which transition (from which energy level to which energy level) created this line.
7. Check your prediction by using Balmer's formula to calculate the wavelength that the transition would have caused. Compare the calculated wavelength with the wavelength of the spectral line that you selected.